GCE Morris Solar

54 South Street Morris, CT

PREPARED FOR

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Introduction

The purpose of this acoustical study is to evaluate the potential noise impacts associated with the operation of the proposed Greenskies Development Company, LLC Morris Solar Project (the Project) located at 54 South Street in Morris, Connecticut. This acoustical assessment evaluated the potential sound levels generated by the mechanical equipment, including the inverters, transformers, and single-axis tracking panel systems, that will be part of the Project. The sound levels were compared to the Connecticut Department of Energy and Environmental Protection's (CT DEEP) noise control regulations (Regulations of Connecticut State Agencies (RCSA), Title 22a, Section 22a-69-1 to 22a-69-7). This technical report presents a summary of the Project, the regulatory context for evaluating sound, and an evaluation of sound from the proposed Project.

Project Description

The proposed Project consists of the development of an approximately 5.0-Megawatt (MW) alternating current (AC) ground-mounted solar photovoltaic (PV) facility to be located on approximately 21-acres of a 75.2-acre parcel. The parcel is located at 54 South Street in Morris, Connecticut (M/B/L 09/680/54). The Project Site shall be considered to be the 21-acre portion of the parcel.

The facility will consist of one fixed array (south) and one tracking array (north). The tracking array will have a total of 74 tracking motors. There will be two equipment pads each with one 2500 kVA transformer and 20 125 kW string inverters.

Fundamentals of Noise

Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, communication, work, or recreation. How people perceive sound depends on several measurable physical characteristics, which include the following:

- **Intensity** – Sound intensity is often equated to loudness.
- **Frequency** – Sounds are comprised of acoustic energy distributed over a variety of frequencies. Acoustic frequencies, commonly referred to as tone or pitch, are typically measured in Hertz. Pure tones have all their energy concentrated in a narrow frequency range.

Sound levels are most often measured on a logarithmic scale of decibels (dB). The decibel scale compresses the audible acoustic pressure levels which can vary from the threshold of hearing (zero dB) to the threshold of pain (120 dB). Because sound levels are measured in dB, the addition of two sound levels is not linear. Adding two equal sound levels creates a 3 dB increase in the overall level. Research indicates the following general relationships between changes in sound level and human perception:

- A 3 dB increase is a doubling of acoustic energy and is the threshold of perceptibility to the average person.
- A 10 dB increase is a tenfold increase in acoustic energy but is perceived as a doubling in loudness to the average person.

The human ear does not perceive sound levels from each frequency as equally loud. To compensate for this phenomenon in perception, a frequency filter known as A weighted [dB(A)] is used to evaluate environmental noise levels. **Table 1** presents a list of common outdoor and indoor sound levels.

Table 1. Common Outdoor and Indoor Sound Levels

Outdoor Sound Levels	Sound Pressure (μPa)*		Sound Level dB(A)**	Indoor Sound Levels
	6,324,555	-	110	Rock Band at 5 m
Jet Over Flight at 300 m		-	105	
	2,000,000	-	100	Inside New York Subway Train
Gas Lawn Mower at 1 m		-	95	
	632,456	-	90	Food Blender at 1 m
Diesel Truck at 15 m		-	85	
Noisy Urban Area—Daytime	200,000	-	80	Garbage Disposal at 1 m
		-	75	Shouting at 1 m
Gas Lawn Mower at 30 m	63,246	-	70	Vacuum Cleaner at 3 m
Suburban Commercial Area		-	65	Normal Speech at 1 m
	20,000	-	60	
Quiet Urban Area—Daytime		-	55	Quiet Conversation at 1 m
	6,325	-	50	Dishwasher Next Room
Quiet Urban Area—Nighttime		-	45	
	2,000	-	40	Empty Theater or Library
Quiet Suburb—Nighttime		-	35	
	632	-	30	Quiet Bedroom at Night
Quiet Rural Area—Nighttime		-	25	Empty Concert Hall
Rustling Leaves	200	-	20	
		-	15	Broadcast and Recording Studios
	63	-	10	
		-	5	
Reference Pressure Level	20	-	0	Threshold of Hearing

Source: Highway Noise Fundamentals. Federal Highway Administration, September 1980.

* mPA – MicroPascals, which describe pressure. The pressure level is what sound level monitors measure.

** dB(A) – A weighted decibels, which describe sound pressure logarithmically with respect to 20 mPa (the reference pressure level).

A variety of sound level indicators can be used for environmental noise analysis. These indicators describe the variations in intensity and sequential pattern of the sound levels. The indicators used in this analysis are defined as follows:

- Leq is the equivalent continuous A-weighted sound level, which is the value or level of a steady, non-fluctuating sound with the same acoustic energy as the actual time-varying sound levels over a given time period.
- L10 is the A-weighted sound level, which is exceeded for 10 percent of the time over a given time period.
- L90 is the A-weighted sound level, which is exceeded for 90 percent of the time over a given time period. The L90 is generally considered to be the background sound level.

Noise Impact Criteria

The CT DEEP has developed noise impact criteria that establish sound level thresholds deemed to result in adverse impacts for new developments. The acoustic analysis for the Project used these criteria to evaluate whether the Project will generate sound levels that result in adverse impacts.

The CT DEEP's noise control regulations identify the limits of sound that can be emitted from specific premises and what activities are exempt. The noise control regulations (Title 22a, §§ 22a-69-1 to 22a 69-7) are contained in the RCSA. The proposed Project is considered a Class C (Industrial) emitter by the CT DEEP. Nearby residences are Class A (Residential and Religious Facility) Receptors. The land use in Class A noise zone is characterized as generally residential where human beings sleep, or areas where serenity and tranquility are essential to the intended use of the land. Though some adjacent lands are undeveloped or used for non-residential uses, they were conservatively evaluated as Class A Receptors for the purposes of this study.

The CT DEEP policy states that a source (emitter) located in the various zones shall not emit noise exceeding the levels stated in **Table 2** at the adjacent noise zones.

Table 2. Noise Zone Standards (dB(A))

	Receptor Noise Zone			
Emitter Zone	Class A (Daytime)	Class A (Nighttime)	Class B	Class C
Class A (Residential)	55	45	55	62
Class B (Commercial)	55	45	62	62
Class C (Industrial)	61	51	66	70

Source: Control of Noise (Title 22a, Section 22a-69-1 to 22a-69-7.4), RCSA, Revised 2015-3-6.

The CT DEEP's noise regulation includes a prominent discrete tone criteria which identifies limits which each one-third octave band center frequency should not exceed any adjacent one-third octave band center frequency (Title 22a, §§ 22a-69-1.2(r)). The manufacturer specifications for the proposed equipment did not provide one-third octave band sound levels. As such, a 5 dB(A) penalty was applied to the criteria to conservatively evaluate the potential for tonal noise from the facility.

The noise control regulations (Title 22a, §§ 22a-69-3.6) take into consideration projects that are to be located in areas with high existing background noise. For such areas, the noise emitted by

the project sources are considered to cause excessive noise if they emit levels 5 dB(A) above the background noise. It was conservatively assumed that existing sounds levels in this area would not be above the CT DEEP criteria; as such, the sound levels in **Table 2**, with a 5 dB(A) penalty for tonal noise would be applicable to this Project. The Town of Morris does not have a noise ordinance, therefore, the project will be subject to the CT DEEP noise regulations and limited to 56 dB(A) daytime and 46 dB(A) nighttime sound level limits.

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Acoustical Assessment

Methodology

This acoustical assessment evaluated the sound levels from the Project's proposed mechanical equipment. The Project's noise sources consist of thirty-four electrical inverters used to convert the solar energy to usable electricity, three transformers, and seventy-four small actuator motors that move the single-axis panel tracking system to follow the sun. Equipment locations are presented in **Figure 1**.

The Project-generated sound levels were calculated using manufacturer's sound data and the principles of acoustical propagation of sound over distance and were calculated for each sensitive receptor location. The sources of operational noise associated with the proposed project include:

- Forty (40) Solectria three-phase string inverters XGI 1500-125/125-UL;
- Two (2) 2500 kVA transformers; and
- Seventy-four (74) Nevados tracking system motors.

The sound power level data for these pieces of equipment are provided in **Table 3**. The sound power level for the inverters was based on the manufacturer's specifications. The reference sound levels for the transformers are based on an empirical approach obtained from the literature that relates the kVA-rating of an air-cooled transformer to its sound power level.[1] Reference sound level data for the tracking system motors were obtained from the manufacturer's testing of the equipment.[2] See **Attachment A** for manufacturer's specifications.

1 Barron, Randall F., "Industrial Noise Control and Acoustics," Marcel Dekker, Inc., Table 5-7, pp. 177-178, 2003.

2 Nevados Single Axis Tracker. May 1, 2025.

Table 3. Modeled Sound Power Levels

	Sound Power Levels (dB) by Octave Band Center Frequency (Hz)								Overall	
Equipment	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dB(A)**	**dB**
Solectria Inverter[1]	--	--	--	--	--	--	--	--	81	84
2500 kVA Transformer[2]	84	88	82	78	78	72	67	61	82	90
Tracking Motor[3]	--	--	--	--	--	--	--	--	74	78

1 Yaskawa Solectria Solar, 4/26/2023.
2 Barron, 2003.
3 Nevados Single Axis Tracker Motor, 5/1/2025.

The A-weighted sound pressure levels due to the operation of the Project were predicted at the receptor locations using the acoustic modeling software CadnaA[3] (Computer Aided Noise Abatement) by Datakustik. CadnaA is an internationally accepted sound prediction program that implements the International Standards Organization (ISO) 9613-2 (2024) sound propagation standard. The noise prediction model accounts for the sound emissions of equipment, the ground cover, terrain, and the geometry of the project area. The assessment assumed all equipment operating simultaneously during the daytime period. Sound propagation was assumed to occur over acoustically "soft" ground (G=1.0). The ground at the equipment pad – the location at which the inverters and transformers would be installed – was assumed to be acoustically "hard" ground (G=0.0). Receptors were modeled at a height of 1.5 m (5-feet) above the ground. The noise prediction model did not account for excess attenuation provided by trees, or by any on-site or off-site structures, lending some conservatism to the results. The results were compared to the CT DEEP noise impact criteria for determining compliance.

Receptor Locations

A total of twenty-one receptor locations were identified in the vicinity of the Project Site (see **Figure 1**). The receptor locations were selected based on their proximity to the Project Site and their land use. As previously stated, some adjacent lands are undeveloped or used for non-residential uses, but for the purposes of this study were conservatively evaluated as Class A Receptors as defined by the CTDEEP (Title 22a, §§ 22a-69-2.3).

3 DataKustik GmbH, 2025. Computer Aided Noise Abatement Model.

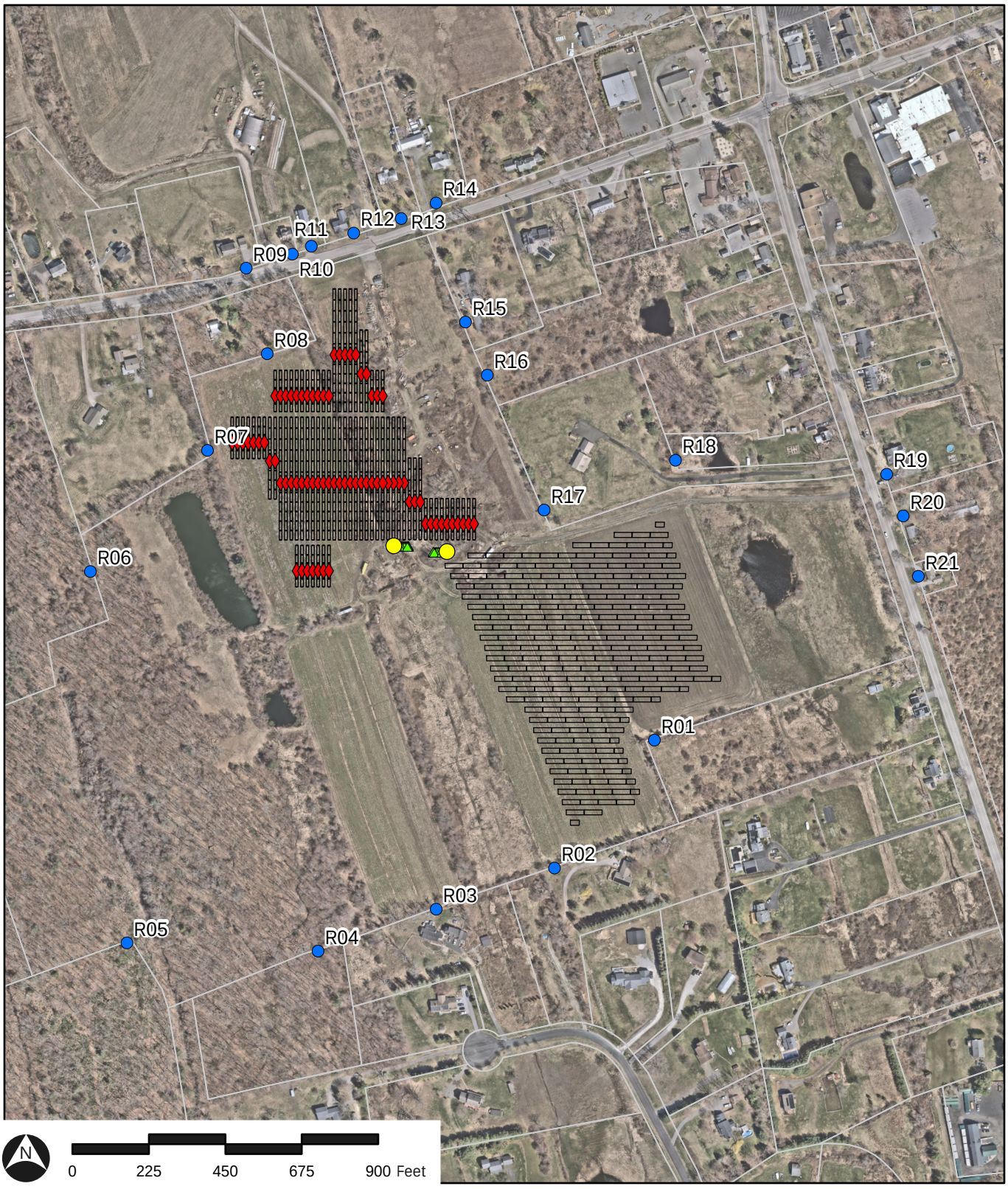

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Figure 1: Noise Receptor and Equipment Locations
Morris Solar
Morris, Connecticut
July 31, 2025

Source: CTDEEP, NearMap, and VHB 2025.

Future Conditions

VHB evaluated the potential sound level impacts associated with the Project's proposed mechanical equipment at the nearby sensitive receptor locations. This analysis evaluated the potential sound level impacts from the 40 inverters, two transformers, and 74 tracking system motors operating simultaneously.

The potential sound levels associated with the proposed equipment were determined by comparing the predicted Project generated sound levels to the CT DEEP's noise standards. The results of the acoustical analysis demonstrated that the operation of the proposed equipment will comply with CT DEEP's noise standards at the sensitive receptor locations. The sound levels attributed to the proposed equipment ranges from approximately 20 dB(A) at Receptor R06, 133 West St, to 35 dB(A) at Receptor R07, 95 West St. These sound levels are below CT DEEP's daytime criteria of 56 dB(A) and the nighttime criteria of 46 dB(A) with a 5 dB(A) penalty applied for potential tonal noise. Due to the nature of the Project, the solar equipment will not be operating during the nighttime period and therefore would not make noise during the nighttime. However, the nighttime criteria comparison has been included for information purposes to demonstrate compliance.

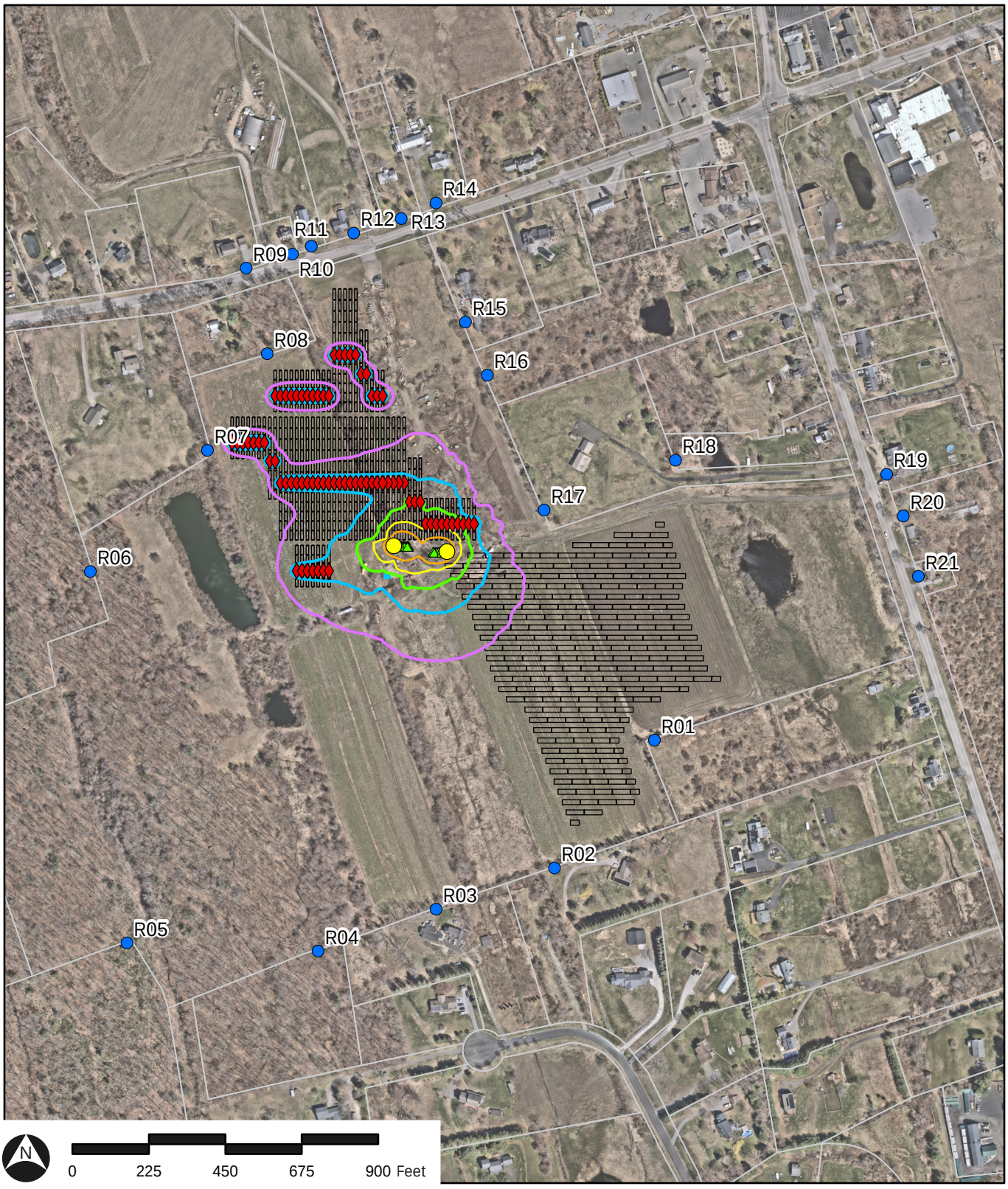
Table 4 summarizes the sound levels due to the operation of the inverters, transformers, and tracking motors at the receptor locations.

Table 4. Sound Levels at Receptor Locations, dB(A) – Due to Transformers, Inverters, and Tracking Motors

Receptor Locations	CT DEEP Noise Standard* (Daytime/Nighttime)	Project Generated Sound Levels
R01 – 72 SOUTH ST	56/46	31.6
R02 – 68 PLATT FARM RD	56/46	31.4
R03 – 78 PLATT FARM RD	56/46	30.9
R04 – NO ADDRESS	56/46	29.2
R05 – 84 PLATT FARM RD	56/46	27.1
R06 – 133 WEST ST	56/46	20.3
R07 – 95 WEST ST	56/46	34.8
R08 – 85 WEST ST	56/46	33.8
R09 – 84 WEST ST	56/46	29.8
R10 – 74 WEST ST	56/46	30.8
R11 – 68 WEST ST	56/46	30.7
R12 – 62 WEST ST	56/46	30.2
R13 – 44 WEST ST	56/46	27.3
R14 – 36 WEST ST	56/46	24.1
R15 – 35 WEST ST	56/46	28.2
R16 – 16 SOUTH ST	56/46	30.4
R17 – 42 SOUTH ST	56/46	32.9
R18 – 38 SOUTH ST	56/46	23.1
R19 – 43 SOUTH ST	56/46	20.4
R20 – 51 SOUTH ST	56/46	20.8
R21 – 57 SOUTH ST	56/46	21.6

* Noise standard for Class C emitter and Class A receptor, unless otherwise noted.
CT DEEP noise standard with 5 dB(A) penalty applied.

Figure 2 presents sound level contours (i.e., lines of equal sound level that are analogous to topographic contours that are lines of equal ground elevation) for the operation of the inverters, transformers, and tracking motors. The sound level contours in **Figure 2** exclude contributions from off-site sources of sound.



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* Nighttime sound level limits with 5 dBA penalty
** Daytime sound level limits with 5 dBA penalty

Figure 2: Modeled Sound Level Contours with Transformers, Inverters, and Tracking Motors
Morris Solar
Morris, Connecticut
July 31, 2025

Source: CTDEEP, NearMap, and VHB 2025.

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Findings

Conclusion of Acoustical Assessment

In this acoustical analysis, VHB evaluated the sound levels associated with the Project's mechanical equipment which includes 40 inverters, two transformers, and 74 tracking system motors. This analysis conservatively assumed that the properties abutting the Project Site currently experience sound levels below CT DEEP's noise standards and the high background noise areas guidance (Sec 22a-69-3.6) do not apply to the Project.

Due to the low noise equipment and sufficient distance between the proposed equipment and the nearby property boundaries, the sound levels associated with the Project's mechanical equipment are expected to comply with CT DEEP's noise standards and have no adverse noise impacts at nearby sensitive receptor locations. Noise mitigation is not necessary for the Project.

Construction Activities

Construction activities, including the intermittent use of heavy machinery, may result in temporary increases in nearby sound levels at the proposed Project. The Project is expected to generate typical sound levels from construction activities, including truck movements, heavy equipment operations, and general construction activities. Heavy machinery, such as front-end loaders, graders, bull dozers, and backhoes, would be used intermittently throughout the proposed Project's construction.

Section 22a-69-1.8(g) of the CT DEEP's noise control regulation states that noise associated with construction activities are exempt from the regulation. However, even though construction noise is exempt from the regulation, construction activities such as site excavation/grading and installation of the solar panel systems would typically be limited to normal daytime working hours. Construction activities beyond normal daytime work hours would be minimized to the extent practicable.

Attachments

Attachment A: Equipment Noise Specifications

SOLECTRIA® XGI 1500-166 SERIES

PREMIUM 3-PHASE TRANSFORMERLESS UTILITY-SCALE INVERTERS

FEATURES

- Made in the USA with global components
- Buy American Act (BAA) compliant
- Four models:
  - 125kW/125kVA,
  - 125kW/150kVA,
  - 150kW/166kVA,
  - 166kW/166kVA
- Additional models available certified to UL1699b, Photovoltaic DC Arc-Fault Circuit Protection
- 99.0% peak efficiency
- Flexible solution for distributed and centralized system architecture
- Advanced grid-support functionality Rule 21/UL1741SB
- Robust, dependable, & built to last
- Lowest O&M and installation costs
- Access all inverters on site via WiFi from one location
- Remote diagnostics and firmware upgrades
- SunSpec Modbus Certified
- Tested compatible with the TESLA PowerPack Microgrid System app for system visibility

OPTIONS

- String combiners for distributed and centralized systems
- Web-based monitoring
- Extended warranty

Yaskawa Solectria Solar's XGI 1500 utility-scale string inverters are designed for high reliability and built of the highest quality components that were selected, tested and proven to last beyond their warranty.

XGI 1500 inverters provide advanced grid-support functionality and meet the latest IEEE 1547 and UL1741SB standards for safety. They are the most powerful 1500 VDC string inverters in the PV market and have been engineered for both distributed and centralized system architecture.

Designed and engineered in Lawrence, MA, XGI inverters are assembled and tested at Yaskawa America's facilities in Buffalo Grove, IL. They are Made in the USA with global components and are compliant with the Buy American Act.

YASKAWA
SOLECTRIA SOLAR

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Document No. FL.XGI1500.01 | 04/26/2023 |

SPECIFICATIONS

SOLECTRIA XGI 1500 Model		XGI 1500-125/125-UL XGI 1500-125/125-UL-A	XGI 1500-125/150-UL XGI 1500-125/150-UL-A	XGI 1500-150/166-UL XGI 1500-150/166-UL-A	XGI 1500-166/166-UL XGI 1500-166/166-UL-A
DC Input	Absolute Max Input Voltage	1500 VDC	1500 VDC	1500 VDC	1500 VDC
	Max Power Input Voltage Range (MPPT)	860-1250 VDC	860-1250 VDC	860-1250 VDC	860-1250 VDC
	Operating Voltage Range (MPPT)	860-1450 VDC	860-1450 VDC	860-1450 VDC	860-1450 VDC
	Number of MPP Trackers	1 MPPT	1 MPPT	1 MPPT	1 MPPT
	Max Operating Input Current	148.3 A	148.3 A	178.0 A	197.7 A
	Max Operating PV Power	128 kW	128 kW	153 kW	170 kW
	Max DC/AC Ratio | Max Rated PV Power	2.6 | 332 kW	2.6 | 332 kW	2.2 | 332 kW	2.0 | 332 kW
	Max Rated PV Short-Circuit Current (∑Isc x 1.25)	500 A	500 A	500 A	500 A
AC Output	Nominal Output Voltage	600 VAC, 3-Ph	600 VAC, 3-Ph	600 VAC, 3-Ph	600 VAC, 3-Ph
	AC Voltage Range	-12% to +10%	-12% to +10%	-12% to +10%	-12% to +10%
	Continuous Real Output Power	125 kW	125 kW	150 kW	166 kW
	Continuous Apparent Output Power	125 kVA	150 kVA	166 kVA	166 kVA
	Max Output Current	120 A	144 A	160 A	160 A
	Nominal Output Frequency	60 Hz	60 Hz	60 Hz	60 Hz
	Power Factor (Unity default)	+/- 0.80 Adjustable	+/- 0.80 Adjustable	+/- 0.80 Adjustable	+/- 0.80 Adjustable
	Total Harmonic Distortion (THD) @ Rated Load	<3%	<3%	<3%	<3%
	Grid Connection Type	3-Ph + N/GND	3-Ph + N/GND	3-Ph + N/GND	3-Ph + N/GND
	Fault Current Contribution (1 cycle RMS)	144 A	173 A	192 A	192 A
Efficiency	Peak Efficiency	98.9%	98.9%	99.0%	99.0%
	CEC Average Efficiency	98.5%	98.5%	98.5%	98.5%
	Tare Loss	2.75 W	2.75 W	2.75 W	2.75 W
Temperature	Ambient Temp Range	-40°F to 140°F (-40C to 60C)		-40°F to 140°F (-40C to 60C)	
	De-Rating Temperature	122°F (50C)		113°F (45C)	
	Storage Temperature Range	-40°F to 167°F (-40C to 75C)		-40°F to 167°F (-40C to 75C)	
	Relative Humidity (non-condensing)	0 - 95%		0 - 95%	
	Operating Altitude	Full Power up to 9,840 ft (3.0 km); De-Rate to 70% of Full Power at 13,123 ft (4.0 km)			
Communications	Advanced Graphical User Interface	WiFi			
	Communication Interface	Ethernet			
	Third-Party Monitoring Protocol	SunSpec Modbus TCP/IP			
	Web-Based Monitoring	Optional			
	Firmware Updates	Remote and Local			
Testing & Certifications	Safety Listings & Certifications	UL1741SB, IEEE 1547, UL 1998 (All models) UL 1699b Photovoltaic Arc-Fault Circuit Protection Certified (-A models)			
	Advanced Grid Support Functionality	Rule 21, UL 1741SB			
	Testing Agency	ETL			
	FCC Compliance	FCC Part 15 (Subpart B, Class A)			
Warranty	Standard and Options	5 Years Standard; Option for 10 Years			
Enclosure	Acoustic Noise Rating	73 dBA @ 1 m ; 67dBA @ 3 m			
	DC Disconnect	Integrated 2-Pole 250 A DC Disconnect			
	Mounting Angle	Vertical only			
	Dimensions	Height: 29.5 in. (750 mm) | Width: 39.4 in. (1000 mm) | Depth: 15.1 in. (380 mm)			
	Weight	270 lbs (122 kg)			
	Enclosure Rating and Finish	Type 4X, Polyester Powder-Coated Aluminum			

IT'S PERSONAL

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